Optimizing Parameters for Deep-Space Optical Communication

A paper discusses the optimization of the parameters of a high-rate, deep-space optical communication link that utilizes pulse-position modulation (PPM) and an error-correcting code (ECC). The parameters in question include the PPM order (number of pulse time slots in one symbol period), the ECC rate, and the uncoded symbol error rate. In simple terms, the optimization problem is to choose the combination of these parameters that maximizes the throughput data rate at a given bit-error-rate (BER), subject to several constraints, including limits on the average and peak power and possibly a limit on the uncoded symbol error rate. This is a complex, multidimensional optimization problem, the solution of which involves computation of channel capacities for various combinations of the parameters. The paper presents extensive theoretical analyses and numerical predictions that elucidate the many facets of the optimization problem. It shows how a nearly optimum solution can be obtained by choosing the optimum PPM order for the desired number of bits per slot and concatenating the PPM mapping with an error-correction code so that the decoded bits satisfy some BER threshold.

This work was done by Bruce Moison and Jon Hamkins of Caltech for NASA's Jet Propulsion Laboratory. For further information, access the Technical Support Package (TSP) free on-line at www.techbriefs.com/tsp under the Electronics/Computers category. NPO-40591